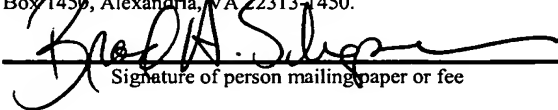


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10
**COIL INNERSPRING ASSEMBLY
HAVING VARYING DEGREES OF FIRMNESS**

15
REFERENCE TO RELATED APPLICATIONS

The present application claims the benefit of Provisional Application Serial
20 No. 60/429,626 filed on November 27, 2002, the contents of which are hereby
incorporated by reference in their entirety.

FIELD OF THE INVENTION

The present invention generally relates to coil innerspring assemblies, and
25 more particularly relates to coil innerspring assemblies having varying degrees of
firmness.

BACKGROUND OF THE INVENTION

A variety of mattress designs having coil innerspring assemblies have been developed within the industry and have been in use for a number of years. Most of these innerspring mattresses were designed to have uniform firmness across their entire length and/or width, with each spring in the mattress exerting the same level of resistance for a given spring deformation.

In recent years, coil innerspring assemblies have been developed which provide the mattress with multiple sections having different degrees of firmness. The variation in firmness between mattress sections is often referred to as “posturized” or “posturization”. One example of a posturized coil innerspring assembly is described in U.S. Patent No. 6,398,199 to Barber. As disclosed in the ‘199 patent, the weight of different regions of an individual’s body can vary significantly (e.g., the head, torso and leg regions). As a result, the different regions of the body tend to exert different forces or loadings onto the corresponding sections of the mattress when the individual lies on the mattress in a prone position. For example, the head and leg regions of the body tend to exert less force or loading onto the mattress compared to the torso region of the body. To accommodate for this variation in loading, the coil innerspring assembly disclosed in the ‘199 patent is designed to provide the innerspring mattress with multiple sections or areas having different degrees of firmness or resistance to loading.

While advances have been made in the industry to provide an innerspring mattress having increased comfort, there is a continuing need to provide improved coil innerspring assemblies, particularly with regard to coil innerspring assemblies having a firmness which varies between initial loading of the mattress (e.g., when an individual first lies down on the mattress) and on-going loading of the mattress (e.g.,

continued support of the individual lying on the mattress).

Thus, there is a general need in the industry to provide an improved coil innerspring assembly having varying degrees of firmness. The present invention meets this need and provides other benefits and advantages in a novel and unobvious manner.

5

SUMMARY OF THE INVENTION

The present invention relates generally to an innerspring assembly having varying degrees of firmness which may be incorporated into, for example, an innerspring mattress. While the actual nature of the invention covered herein can only
5 be determined with reference to the claims appended hereto, certain forms of the invention that are characteristic of the preferred embodiments disclosed herein are described briefly as follows.

In one form of the invention, an innerspring assembly is provided which includes at least two sets of coil springs. A first set of coil springs has a first
10 height, a second set of coil springs has a second height that is different from the first height, and wherein one of the first and second sets of coil springs is compressed upon initial loading of the innerspring assembly, and wherein each of the first and second sets of coil springs is compressed upon continued loading of the innerspring assembly.

15 In another form of the invention, an innerspring assembly is provided which includes at least two sets of coil springs. A first set of coil springs has an upper surface arranged at a first elevation, a second set of coil springs has an upper surface arranged at a second elevation that is different from the first elevation, and wherein one of the first and second sets of coil springs is compressed upon initial
20 loading of the innerspring assembly, and wherein each of the first and second sets of coil springs is compressed upon continued loading of the innerspring assembly.

In another form of the invention, an innerspring assembly is provided which includes at least two sets of coil springs. A first set of coil springs is pre-loaded to a first compressed state, a second set of coil springs is pre-loaded to a

second compressed state, and wherein the first and second compressed states exhibit different degrees of firmness.

In another form of the invention, an innerspring assembly is provided which includes at least two sets of coil springs. A first set of coil springs has a barrel-shaped outer profile defining a convex side surface, a second set of coil springs has an hourglass-shaped outer profile defining a concave side surface, and wherein the convex side surface of one of the barrel-shaped coil springs is positioned proximate the concave side surface of an adjacent one of the hourglass-shaped coil springs.

In another form of the invention, an innerspring assembly is provided which includes at least two sets of coil springs. A first set of coil springs has a barrel-shaped outer profile defining a first outer coil diameter, a second set of coil springs has a barrel-shaped outer profile defining a second outer coil diameter, and wherein the first outer coil diameter of the first set of barrel-shaped coil springs is different from the second outer coil diameter of the second set of barrel-shaped coil springs.

It is one object of the present invention to provide an improved coil innerspring assembly.

Further objects, features, advantages, benefits, and/or further aspects of the present invention will become apparent from the drawings and description set forth herein.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

FIG. 1 is a side perspective view of an innerspring assembly according to one form of the present invention, including first and second sets of coil innersprings having different pocketed heights to provide the innerspring assembly with varying
5 degrees of firmness.

FIG. 2 is a partial end elevational view of the innerspring assembly illustrated in FIG. 1.

FIG. 3 is a partial end elevational view of an alternative embodiment of the innerspring assembly illustrated in FIG. 1, wherein the bottoms of each of the
10 pocketed coil innersprings are arranged flush with one another.

FIG. 4 is a side elevational view of a coil spring according to one embodiment of the invention for use in association with the innerspring assembly illustrated in FIG. 1, as shown in an initial uncompressed state.

FIG. 5a is a side elevational view of the coil spring illustrated in FIG. 4, as
15 shown in a pre-loaded compressed state and encased within a spring pocket to define a first pocketed coil spring height.

FIG. 5b is a side elevational view of the coil spring illustrated in FIG. 4, as shown in a pre-loaded compressed state and encased within a spring pocket to define a second pocketed coil spring height.

FIG. 6 is a side perspective view of the innerspring assembly illustrated in
20 FIG. 1, as integrated into an innerspring mattress according to one embodiment of the present invention.

FIG. 7 is a side perspective view of an innerspring assembly according to another form of the present invention, including first and second sets of pocketed coil
25 innersprings having different pocketed heights to provide the innerspring assembly

with varying degrees of firmness.

FIG. 8 is a partial end elevational view of an alternative embodiment of the innerspring assembly illustrated in FIG. 1, wherein a first set of the pocketed coil innersprings is barrel-shaped and a second set of the pocketed coil innersprings is
5 hourglass-shaped.

FIG. 9 is a partial end elevational view of an alternative embodiment of the innerspring assembly illustrated in FIG. 8, wherein the bottoms of each of the barrel-shaped and hourglass-shaped pocketed coil innersprings are arranged flush with one another.

10 FIG. 10 is a partial end elevational view of an alternative embodiment of the innerspring assembly illustrated in FIG. 8, wherein each of the barrel-shaped and hourglass-shaped pocketed coil innersprings has a uniform height.

FIG. 11 is a partial end elevational view of an alternative embodiment of the innerspring assembly illustrated in FIG. 1, wherein the first and second sets of
15 pocketed coil innersprings have different coil diameters.

FIG. 12 is a partial end elevational view of an alternative embodiment of the innerspring assembly illustrated in FIG. 11, wherein the bottoms of each of the pocketed coil innersprings are arranged flush with one another.

FIG. 13 is a partial end elevational view of an alternative embodiment of the innerspring assembly illustrated in FIG. 11, wherein each of the pocketed coil
20 innersprings has a uniform height.

FIG. 14 is a partial end elevational view of an alternative embodiment of the innerspring assembly illustrated in FIG. 1, wherein each of the pocketed coil innersprings has a uniform height, with a first set of the pocketed coil innersprings
25 arranged at a different elevation relative to a second set of the pocketed coil

innersprings to provide the innerspring assembly with varying degrees of firmness.

FIG. 15a is a side elevational view of a coil spring according to one embodiment of the invention for use in association with the innerspring assembly illustrated in FIG. 14, as shown in an initial uncompressed state.

5 FIG. 15b is a side elevational view of a coil spring according to another embodiment of the invention for use in association with the innerspring assembly illustrated in FIG. 14, as shown in an initial uncompressed state.

FIG. 16a is a side elevational view of the coil spring illustrated in FIG. 15a, as shown in a pre-loaded compressed state and encased within a spring pocket to define
10 a pocketed coil spring height.

FIG. 16b is a side elevational view of the coil spring illustrated in FIG. 15b, as shown in a pre-loaded compressed state and encased within a spring pocket to define a pocketed coil spring height.

DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

For the purposes of promoting an understanding of the principles of the invention, reference will now be made to the embodiments illustrated in the drawings and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is hereby intended, such alterations and further modifications in the illustrated devices, and such further applications of the principles of the invention as illustrated herein being contemplated as would normally occur to one skilled in the art to which the invention relates.

Referring to FIG. 1, shown therein is a coil innerspring assembly 100 according to one form of the present invention. The innerspring assembly 100 is generally comprised of a plurality of pocketed coil springs and has a length l extending generally along a longitudinal axis L and a width w extending generally along a transverse axis T . As will be discussed in greater detail below, each of the pocketed coil springs preferably includes an inner coil spring individually encased within an outer spring pocket.

In a preferred embodiment of the invention, the innerspring assembly 100 includes at least two sets or groups of pocketed coil springs having different pocketed heights. In the illustrated embodiment of the invention, the innerspring assembly 100 includes a first set of pocketed coil springs 102 having first height h_1 and a second set of pocketed coil springs 104 having lesser second height h_2 . However, it should be understood that in other embodiments of the invention, the innerspring assembly 100 may include three or more sets of pocketed coil springs, with each set of pocketed coil springs having a different pocketed height. As will be discussed in greater detail below, the first set of pocketed coil springs 102 (having the greater height h_1) provides a degree of initial comfort or plush as the occupant(s) lies down on the

innerspring assembly 100, while the second set of pocketed coil springs 104 (having the lesser height h_2) subsequently provides an added degree of firmness to the innerspring assembly 100 to properly support the occupant(s).

In the illustrated embodiment of the innerspring assembly 100, the first and second sets of the pocketed coil springs 102, 104 are each arranged in axially extending rows or strings R_1 , R_2 , respectively, running along the length l of the innerspring assembly 100 (i.e., in a head-to-toe direction). However, in other embodiments of the invention, each of the first and second sets of the pocketed coil springs 102, 104 may alternatively be arranged in transversely extending rows or strings running across the width w of the innerspring assembly 100 (i.e., in a side-to-side direction). In the illustrated embodiment of the innerspring assembly 100, the rows R_1 , R_2 of the first and second sets of the pocketed coil springs 102, 104 are disposed in an alternating relationship, with each row R_1 of the first set of pocketed coil springs 102 being positioned adjacent a row R_2 of the second set of pocketed coil springs 104.

In other embodiments of the invention, the rows R_1 , R_2 of the first and second sets of pocketed coil springs 102, 104 may be arranged to define alternative configurations of the innerspring assembly 100. For example, two or more rows R_1 of the pocketed coil springs 102 may be positioned laterally adjacent one another to form one or more sections or zones of pocketed coil springs having a first height h_1 and/or two or more rows R_2 of the pocketed coil springs 104 may be positioned laterally adjacent one another to form one or more sections or zones of pocketed coil springs having a second height h_2 . As should be appreciated, the section(s) of coil springs 102 having the height h_1 would provide a different “feel” or degree of firmness compared to the section(s) of coil springs 104 having the height h_2 . This variation in

feel or firmness between two or more zones is sometimes referred to as “posturized” or “posturization”. As should also be appreciated, the innerspring assembly 100 may include three or more sections or zones of pocketed coil springs, each exhibiting a different feel or degree of firmness, thereby providing the innerspring assembly 100
5 with an even greater level of posturization.

In one embodiment of the invention, the innerspring assembly 100 may include three discrete posturized sections or zones extending across the width w to accommodate for the particular loading requirements associated with various regions of the occupant’s body (e.g., the head, torso and leg regions) when lying on the
10 innerspring assembly 100 in a prone position. In another embodiment of the invention, the innerspring assembly 100 may include two discrete posturized sections or zones extending along the length l to accommodate for the particular loading requirements associated with respective occupants. Further details regarding other posturized features or arrangements that may be used in association with the present
15 invention are illustrated and described in U.S. Patent No. 6,398,199 to Barber, the contents of which have been incorporated herein by reference.

In one embodiment of the invention, each row R_1 , R_2 of the first and second sets of pocketed coil springs 102, 104 is formed as an integral/continuous strip or string S , with each strip S including a plurality of interconnected pocketed coil springs
20 arranged in an upright or upstanding orientation. One method of forming the strips S of pocketed coil springs is illustrated and described in U.S. Patent No. 6,398,199 to Barber, the contents of which have been incorporated herein by reference. Another method of forming the strips S of pocketed coil springs is illustrated and described in a co-pending U.S. Utility Application entitled “Encased Coil Innerspring Assembly”
25 (Atty. Docket No. 3050-136), the contents of which are hereby incorporated herein by

reference. It should be understood, however, that other methods of forming strips of pocketed coil springs are also contemplated as would occur to one of skill in the art.

In another embodiment of the invention, adjacent strips S of the pocketed coil springs may be coupled together via any number of a variety of methods including, for example, welding, gluing, adhering, wiring, tying, fastening and/or any other method of coupling that would occur to one of skill in the art. As used herein, the term “coupling” is broadly defined to encompass any means for connecting, attaching, affixing, adjoining, linking or any other means for coupling one element to another element. In a further embodiment of the invention, two adjacent strips S of pocketed coil springs may be coupled together, such as, for example, by welding, to form a dual strip S_D of pocketed coil springs. In yet another embodiment of the invention, three adjacent strips S of pocketed coil springs may be coupled together to form a triple strip S_T of pocketed coil springs. Two or more of the dual strips S_D and/or the triple strips S_T of pocketed coil springs may subsequently be coupled together, such as, for example, by gluing, to form the coil innerspring assembly 100. It should be understood that each adjacent pair of pocketed coil springs in the adjacent strips S need not necessarily be coupled together to form the dual strips S_D and/or the triple strips S_T of pocketed coil springs. For example, every other adjacent pair, every third adjacent pair, etc., of pocketed coil springs in the adjacent strips S may be coupled together to form the dual strips S_D and/or triple strips S_T of pocketed coil springs.

One method of forming dual or triple strips of pocketed coil springs and a complete coil innerspring assembly is illustrated and described in a co-pending U.S. Utility Application entitled “Encased Coil Innerspring Assembly” (Atty. Docket No. 3050-136), the contents of which have been incorporated herein by reference. However, it should be understood that other methods for forming dual strips S_D or

triple strips S_T of pocketed coil springs and the complete coil innerspring assembly 100 are also contemplated as would occur to one of skill in the art.

In yet another embodiment of the invention, the pocketed coil springs 102, 104 may be integrated together to form the coil innerspring assembly 100 via the use of a top sheeting member (not shown) and/or a bottom sheeting member (not shown), sometimes referred to as top and bottom scrim. It should be understood that the use of top and/or bottom scrim may be used in lieu of or in addition to the methods described above for forming the coil innerspring assembly 100. One example of integrating a number of pocketed coil springs to form a coil innerspring assembly via the use of a top and bottom scrim is illustrated and described in U.S. Patent No. 6,398,199 to Barber, the contents of which have been incorporated herein by reference.

Referring now to FIG. 2, shown therein is a partial end elevational view of the innerspring assembly 100 illustrating the arrangement and relationship of the first set of pocketed coil springs 102 relative to the second set of pocketed coil springs 104. The pocketed coil springs 102 have an upper surface 102a and an opposite lower surface 102b, thereby defining the first pocketed coil spring height h_1 . Similarly, the pocketed coil springs 104 have an upper surface 104a and an opposite lower surface 104b, thereby defining the second pocketed coil spring height h_2 . As discussed above, the first and second pocketed coil spring heights h_1 , h_2 are different, thereby providing the innerspring assembly 100 with a non-uniform or variable height. As will be discussed in greater detail below, in one embodiment of the invention, the pocketed coil springs 102, 104 each define a barrel-shaped outer profile, with the pocketed coil springs 102 having a convex side surface 102c and the pocketed coil springs 104 having a convex side surface 104c. The adjacent rows R_1 , R_2 of the pocketed coil

springs 102, 104 are arranged such that the convex side surfaces 102c, 104c are positioned proximately adjacent one another, and preferably in direct contact with one another.

In the illustrated embodiment of the invention, adjacent rows R_1 , R_2 of the first and second sets of pocketed coil springs 102, 104 are arranged such that the mid-
portions or waists of the pocketed coil springs 102, 104 extend generally along a central midline axis M, thereby defining an upper offset o_U between the upper pocketed coil spring surfaces 102a, 104a and a lower offset o_L between the lower pocketed coil spring surfaces 102b, 104b. In the illustrated embodiment of the invention, the upper coil spring offset o_U is approximately equal to the lower coil spring offset o_L or, stated another way, the upper and lower coil spring surfaces 102a, 104a and 102b, 104b are positioned approximately equidistant from the central midline axis M. In a specific embodiment of the invention, the pocketed height h_1 of the coil springs 102 is approximately seven (7) inches and the pocketed height h_2 of the coil springs 104 is approximately six (6) inches, thereby providing upper and lower coil spring offsets o_U , o_L of about one-half (0.5) inch each.

It should be understood that the particular arrangement and the specific dimensions of the pocketed coil springs 102, 104 illustrated in FIGS. 1 and 2 are exemplary, and that other arrangements and sizes of the pocketed coil springs 102, 104 are also contemplated as falling within the scope of the present invention. For example, the upper and lower coil spring offsets o_U , o_L need not necessarily be equal. Instead, the upper coil spring offsets o_U may be greater than or less than the lower coil spring offsets o_L . Additionally, as will be discussed more fully below, the lower pocketed coil spring surfaces 102b, 104b may be arranged in a generally flush or planar arrangement, with only the upper pocketed coil spring surfaces 102a, 104a

being offset relative to one another. Likewise, the upper pocketed coil spring surfaces 102a, 104a may be arranged in a generally flush or planar arrangement, with only the lower pocketed coil spring surfaces 102b, 104b being offset relative to one another.

It should also be understood that each of the pocketed coil springs 102 need
5 not necessarily be arranged such that the upper/lower surfaces 102a, 102b are arranged generally flush with one another. Instead, the upper/lower surfaces 102a, 102b of one or more of the pocketed coil springs 102 can be offset or arranged at different elevations relative to one another. Similarly, each of the pocketed coil springs 104 need not necessarily be arranged such that the upper/lower surfaces 104a,
10 104b are arranged generally flush with one another. Instead, the upper/lower surfaces 104a, 104b of one or more of the pocketed coil springs 104 can be offset or arranged at different elevations relative to one another.

It should be appreciated that when an occupant lies down on the innerspring assembly 100, a certain grouping of the pocketed coil springs 102 having the greater
15 height h_i will absorb the initial loading associated with the weight of the occupant. It should also be appreciated that as the pocketed coil springs 102 are compressed and the upper surface 102a of the pocketed coil springs 102 are displaced to a position generally flush or even with the upper surface 104a of the adjacent pocketed coil springs 104 (i.e., with the upper offset o_U at or near zero), the pocketed coil springs
20 104 will also be compressed and will begin to absorb a portion of the loading associated with the weight of the occupant. Since the initial loading of the innerspring assembly 100 is absorbed exclusively by the pocketed coil springs 102, with little to no loading being absorbed by the pocketed coil springs 104, the rate of compression or deflection of the pocketed coil springs 102 will be relatively high. As
25 a result, the innerspring assembly 100 is initially provided with a soft or “plush” feel,

which in turn provides the occupant with an added degree of comfort when the occupant initially lies down on the innerspring assembly 100. However, once the pocketed coil springs 102 are compressed to a point where the upper surfaces 102a, 104a are generally flush or even with one another, the pocketed coil springs 104 will
5 begin to absorb a portion of the loading. The increased resistance to loading provided by the second set of pocketed coil springs 104 results in a reduced rate of compression or deflection of the pocketed coil springs 102, 104. Additionally, the increased resistance to loading provided by the combined effects of the pocketed coil springs 102, 104 gives the innerspring assembly 100 a “firm” feel, which in turn provides the
10 occupant with an added degree of support.

Referring to FIG. 3, shown therein is a coil innerspring assembly 200 according to another embodiment of the present invention. Similar to the innerspring assembly 100, the innerspring assembly 200 is generally comprised of a plurality of pocketed coil springs 102 and 104 arranged in rows R_1 , R_2 , respectively, and defining
15 different pocketed height h_1 , h_2 , respectively. However, the pocketed coil springs 102, 104 of the innerspring assembly 200 are arranged such that the bottom surfaces 102b, 104b are substantially flush or even with one another so as to define an upper coil spring offset o_U between the upper surfaces 102a, 104a, but with no lower coil spring offset. In one embodiment of the invention, adjacent rows R_1 , R_2 of the
20 pocketed coil springs 102, 104 are attached together at a location slightly below a central midline axis M extending along the midportions or waists of the taller pocketed coil springs 102. The innerspring assembly 200 is particularly useful when used in association with one-sided innerspring mattresses, commonly referred to as “no-flip” or “no-turn” mattresses, wherein the upper surfaces 102a, 104a of the
25 pocketed coil springs 102, 104 would preferably remain in an upwardly-facing

direction.

The innerspring assembly 200 functions in a manner similar to that of the innerspring assembly 100. Specifically, when an occupant lies down on the innerspring assembly 200, a certain grouping of the coil springs 102 having the greater height h_1 will absorb the initial loading associated with the weight of the occupant. However, as the coil springs 102 are compressed and the upper surfaces 102a of the coil springs 102 are displaced to a position generally flush or even with the upper surfaces 104a of the adjacent coil springs 104 (i.e., with the upper coil spring offset o_U at or near zero), the coil springs 104 will also be compressed and will begin to absorb a portion of the loading associated with the weight of the occupant. As a result, the pocketed coil springs 102 provide the innerspring assembly 200 with a soft or “plush” feel to provide the occupant with an added degree of comfort, while the combined effects of the pocketed coil springs 102, 104 provide the innerspring assembly 200 with an added degree of support or firmness.

Referring to FIG. 4, shown therein is one embodiment of a coil spring 110 for use in association with the first and second sets of pocketed coil springs 102, 104. In one embodiment of the invention, the coil spring 110 is formed from a metal spring wire including, for example, high carbon spring wire, Marshall Pack spring wire, or any other type of spring wire known to those of skill in the art. In a specific embodiment, the spring wire is automatic coiling and knotting high carbon spring wire. The diameter of the spring wire may vary depending on factors known to those of skill in the art including, for example, the amount of weight to be supported as well and the desired firmness of the coil spring 110. In a specific embodiment, the diameter of the wire used to form the coil spring 110 is 15 gauge. However, other

diameters or gauges of spring wire are also contemplated as falling within the scope of the present invention.

In the illustrated embodiment, the coil spring 110 is wound in a helical or spiral pattern, including an upper coil C_U , a lower coil C_L , and a number of intermediate coils C_I . In one embodiment, the coil spring 110 is configured to define a barrel-shaped outer profile, with the upper coil C_U and the lower coil C_L having a lesser coil diameter than the intermediate coils C_I , and with the intermediate coils C_I increasing in diameter toward the waist or mid-portion of the coil spring 110 to a maximum outer diameter D . In one embodiment, the outer coil diameter D of the coil spring 110 is about two and one-half (2.50) inches. However, it should be understood that the coil springs having other coil diameters are also contemplated as falling within the scope of the present invention.

As will be discussed in greater detail below, other configurations of coil springs are also contemplated for use in association with the present invention. For example, in one embodiment of the invention, some or possibly all of the coil springs 110 may be configured to define an hourglass-shaped outer profile, with the upper coil C_U and the lower coil C_L having a greater coil diameter than the intermediate coils C_I , and with the intermediate coils C_I decreasing in diameter toward the waist or mid-portion of the coil spring 110. It should be appreciated that hourglass-shaped coil springs tend to provide a relatively greater degree of firmness (i.e., resistance to compression or loading) compared to barrel-shaped coil springs. In yet another embodiment of the invention, some or possibly all of the coil springs 110 may be configured to define a cylindrical-shaped outer profile, with the upper coil C_U , the lower coil C_L and the intermediate coils C_I all having a relatively uniform coil diameter. It should be understood that other shapes and configurations of coil springs

in addition to those specifically described above are also contemplated as falling within the scope of the present invention.

In a preferred embodiment of the invention, subsequent to the fabrication of the coil springs 110, some or possibly all of the coil springs 110 are subjected to a heat tempering process. Heat tempering tends to build memory into the coil springs 110, to provide increased spring force/resistance, and/or to extend the longevity of the spring action/resiliency. In one embodiment of the invention, the heat tempering process includes the step of heating the coil springs 110 to a temperature range between about 500° F (260° C) and about 600° F (316° C). In a specific embodiment, the coil springs 110 are heated to the appropriate temperature by running 50 amperes of current across the length of the spring wire for approximately one (1) second. Further details regarding a heat tempering process suitable for use in association with the present invention are disclosed in U.S. Patent No. 6,398,199 to Barber, the contents of which have been incorporated herein by reference. However, other methods for heat tempering or heat treating the coil springs 110 are also contemplated as falling with the scope of the present invention.

Referring to FIGS. 5a and 5b, shown therein are the coil springs 110 individually encased within outer spring pockets 112, 114 to form the pocketed coil springs 102, 104, respectively. As will be discussed below, one purpose of the spring pockets 112, 114 is to maintain the coil springs 110 in a pre-compressed or pre-loaded state. As should be apparent, the interior height of the spring pockets 112, 114 is approximately equal to the finished pocketed height h_1 , h_2 of the pocketed coil springs 102, 104, respectively. Another purpose of the spring pockets 112, 114 is to provide a means for interconnecting adjacent coil springs to form rows or strips of coil springs R_1 , R_2 and/or to interconnect adjacent rows or strips of coil springs to form dual strips

S_D or triple strips S_T of coil springs which can in turn be interconnected to form the innerspring assembly 100. Yet another purpose of the spring pockets 112, 114 is to prevent adjacent coil springs from interfering with one another during compression and/or expansion.

5 The outer spring pockets 112, 114 are preferably formed from a fabric material. In one embodiment of the invention, the fabric is comprised of a material that allows the fabric to be joined or welded together by heat and/or pressure, such as, for example, in an ultrasonic welding procedure or another type of thermal welding procedure. In another embodiment of the invention, the fabric is comprised of a non-
10 woven material. In a specific embodiment, the spring pockets 112, 114 are formed from a non-woven, thermoplastic fiber material, such as, for example, a non-woven polymer-based material, a non-woven polypropylene material, a non-woven polyester material, or any other non-woven fabric material that would occur to one of skill in the art. It should be understood, however, that the spring pockets 112, 114 may be
15 formed from other materials, including woven materials and/or non polymer-based materials. For example, the spring pockets 112, 114 may be formed from a wide variety of textile fabrics or other types of sheet materials known to those of skill in the art. Textile fabric materials are particularly well suited for applications involving stitching, stapling, or other similar methods of interconnecting textile fabric material.

20 In one embodiment of the invention, the spring pockets 112, 114 are formed by providing a sheet of fabric material which is folded in half with the longitudinal or horizontal edges of the sheet being attached together by a longitudinal seam to form a sleeve pocket. The longitudinal seam may be formed, for example, by
thermal/ultrasonic welding. A pre-compressed/pre-loaded coil spring 110 is then
25 inserted into the sleeve in an upright or vertical orientation and the lateral or vertical

edges of the sleeve on each side of the coil spring 110 are attached together by a cross seam to form the individually pocketed coil spring 102, 104. The cross seam may be formed, for example, by thermal/ultrasonic welding. In another embodiment of the invention, the sheet of fabric material may be wrapped or folded about the pre-compressed/pre-loaded coil spring 110 prior to seaming the longitudinal edges of the sheet. It should also be understood that other methods for forming the longitudinal seams and/or the cross seams are also contemplated, including, for example, stitching, stapling or any other method of seaming known to those of skill in the art.

As discussed above, in one embodiment of the invention, a series of pocketed coil springs 102, 104 are interconnected to form an integral/continuous string or strip S, with each strip S including a plurality of coil springs 110 arranged in an upright or vertical orientation. In this embodiment of the invention, a sheet of fabric material is provided having a length somewhat greater than the finished length of the strings S of pocketed coil springs 102, 104. As outlined above, the sheet material is folded in half with the longitudinal or horizontal edges of the sheet being attached together to form an elongate sleeve sized to receive a plurality of pre-compressed/pre-loaded coil springs 110 arranged along the length of the sleeve in an upright or vertical orientation. A vertical cross seam is then formed on each side of each coil spring 110 to form an integral/continuous string S of individually pocketed coil springs 102, 104. Various methods of forming rows or strips of pocketed coil springs are illustrated and described in U.S. Patent No. 6,398,199 to Barber and co-pending U.S. Utility Application entitled "Encased Coil Innerspring Assembly" (Atty. Docket No. 3050-136). It should be understood, however, that other methods of forming strips of pocketed coil springs are also contemplated as would occur to one of skill in the art.

As also discussed above, in one embodiment of the invention, adjacent rows or

strips of the pocketed coil springs 102, 104 may be coupled together using any number of a variety of methods including, for example, thermal/ultrasonic welding to form a dual strip S_D or a triple strip S_T of pocketed coil springs. In one embodiment of the invention, adjacent rows or strips of the pocketed coil springs 102, 104 are
5 coupled together via a vertical weld seam positioned on either side, or possibly one both sides, of one more of the above-discussed vertical cross seams that form the individual springs pockets 112, 114. As also discussed above, one or more of the dual strips S_D and/or the triple strips S_T of pocketed coil springs 102, 104 may subsequently be coupled together, such as, for example, by gluing, to form the
10 complete coil innerspring assembly 100. One method of forming dual strips S_D or triple strips S_T of pocketed coil springs is disclosed in co-pending U.S. Utility Application entitled "Encased Coil Innerspring Assembly" (Atty. Docket No. 3050-136). It should be understood, however, that other methods of forming dual strips S_D or triple strips S_T of pocketed coil springs are also contemplated as would occur to
15 one of skill in the art.

In an alternative embodiment of the invention, the individually pocketed spring coils 102, 104 or the single strips S , dual strips S_D , and/or triple strips S_T of the coil springs 102, 104 may be interconnected via a top securing sheet or scrim (not shown) and/or a bottom securing sheet or scrim (not shown) to form an integrated
20 innerspring assembly 100. The top and bottom scrims may be formed of the same fabric material as the spring pockets 112, 114 or may be formed of a material that is softer and/or more stretchable than the spring pocket material, such as, for example, a polypropylene or polyester material. Alternatively, textile fabrics or other materials known to those of skill in the art may be used. The top and bottom scrims may be
25 attached to the upper surfaces 102a, 104a and lower surfaces 102b, 104b, respectively,

of the pocketed coil springs 102, 104. In one embodiment, the upper and lower
scrim are connected to the pocketed coil springs 102, 104 by a hot melt adhesive.
However, other methods of attachment are also contemplated as would occur to one
of skill in the art. The inclusion of one or both of the top and bottom scrims may
5 provide further securement and/or stabilization of the pocketed coil springs 102, 104
within the innerspring assembly 100. However, it should be understood that the top
and bottom scrims are optional and are not necessarily required to form the
innerspring assembly 100. Further details regarding the use of top and bottom scrims
are illustrated and described in U.S. Patent No. 6,398,199 to Barber.

10 As shown in FIG. 4, the coil spring 110 has an initial height h_i when in an
uncompressed/free-standing/relaxed state. As shown in FIG. 5a, a coil spring 110 is
pre-loaded to a compressed state having a compressed height substantially equal to
the pocketed height h_1 of the pocketed coil spring 102. The compressed coil spring
110 is encased within the spring pocket 112 to maintain the coil spring 110 in the
15 compressed/pre-loaded state. Similarly, as shown in FIG. 5b, a coil spring 110 is pre-
loaded to a compressed state having a compressed height substantially equal to the
pocketed height h_2 of the pocketed coil spring 104. The compressed coil spring 110 is
encased within the spring pocket 114 to maintain the coil spring 110 in the pre-
loaded/compressed state.

20 It should be appreciated that the lesser amount of compression/pre-loading of
the coil springs 102 (from initial height h_i to compressed height h_1) compared to the
compression/pre-loading of the coil springs 104 (from initial height h_i to compressed
height h_2) will correspondingly provide the coil springs 102 with a lesser degree of
firmness or resistance to loading compared to that provided by the coil springs 104.

25 The lesser degree of firmness provided by the coil springs 102 further enhances the

initial “plush” feel provided by the coil springs 102 as the occupant lies down on the innerspring assembly 100, which in turn provides the occupant with an even greater degree of comfort. Additionally, the relatively greater degree of firmness provided by the coil springs 104 provides increased resistance to loading, which in turn provides a greater degree of support to the innerspring assembly 100.

As discussed above, in one embodiment of the invention, the pocketed height h_1 of the coil springs 102 is approximately seven (7) inches, whereas the pocketed height h_2 of the coil springs 104 is approximately six (6) inches. In a further embodiment of the invention, the coil springs 110 have an initial uncompressed/free-standing height h_i of about eight (8) inches. It should therefore be apparent that in this particular embodiment, the coil springs 102 are compressed or preloaded approximately one (1) inch prior to being encased within the spring pocket 112, whereas the coil springs 104 are compressed or preloaded approximately two (2) inches prior to being encased within the spring pocket 114. Assuming all other spring characteristics remain constant (e.g., wire diameter, coil diameter, spring material, etc.), the increased compression or pre-loading of the coil springs 104 will provide the coil springs 104 with a greater degree of firmness relative to the coil springs 102.

Although the illustrated embodiment of the invention utilizes coil springs 110 having the same initial height h_i when in an uncompressed/free-standing state to form the pocketed coil springs 102, 104, it should be understood that the coil springs 110 used to form the pocketed coil springs 102, 104 may have different initial heights h_i . For example, in order to further increase the relative firmness of the pocketed coil springs 104 compared to the pocketed coil springs 102, the initial height h_i of the coil springs 110 used to form the pocketed coil springs 104 can be increased relative to the initial height h_i of the coil springs 110 used to form the pocketed coil springs 102 (i.e.,

the amount of pre-loading associated with the pocketed coil springs 104 may be increased relative to that of the pocketed coil springs 102). Similarly, in order to decrease the relative firmness of the pocketed coil springs 104 compared to the pocketed coil springs 102, the initial height h_i of the coil springs 110 used to form the pocketed coil springs 104 can be correspondingly reduced relative to the initial height h_i of the coil springs 110 used to form the pocketed coil springs 102 (i.e., the amount of pre-loading associated with the pocketed coil springs 104 may be decreased relative to that of the pocketed coil springs 102). In other words, by increasing/decreasing the amount of pre-compression or pre-loading of the coil springs 110 between the initial height h_i and the pocketed heights h_1 , h_2 , the firmness of the pocketed coil spring 102, 104 may be correspondingly increased/decreased.

Although the illustrated embodiment of the invention utilizes coil springs 110 having the same configuration and spring characteristics to form the pocketed coil springs 102, 104, it should be understood that the coil springs used to form the pocketed coil springs 102, 104 can have a different configurations and/or exhibit different spring characteristics. For example, as will be discussed in greater detail below, one of the pocketed coil springs 102, 104 can have a barrel-shaped configuration and the other an hourglass-shaped configuration, with the hourglass-shaped configuration generally providing a relatively greater degree of firmness. As will also be discussed in greater detail below, the pocketed coil springs 102, 104 can utilize coil springs having different coil diameters, with the smaller coil diameter springs generally providing a relatively greater degree of firmness. In another embodiment of the invention, the pocketed coil springs 102, 104 can utilize coil springs having different wire diameters, with the larger wire diameter springs generally providing a relatively greater degree of firmness. In still another

embodiment of the invention, the pocketed coil springs 102, 104 can utilize coil springs having a different number of coils and/or a different spread between the coils, with the springs having the greater number of coils and/or the tighter coil spread generally providing a relatively greater degree of firmness.

5 Referring now to FIG. 6, shown therein is an innerspring mattress assembly 150 according to one form of the present invention. In one embodiment, the innerspring mattress assembly 150 is comprised of the innerspring assembly 100, a sheet of padding material 152a extending along the top of the innerspring assembly 100, a sheet of padding material 152b extending along the bottom of the innerspring
10 assembly 100, and an outer covering 154 extending about the entire innerspring assembly 100.

The sheets of padding material 152a, 152b may include, for example, sheets of foam, filling material, and/or any other type of mattress padding material that would occur to one of skill in the art. In one embodiment of the invention, the sheets of
15 padding material 152a, 152b are attached directly to the upper and lower surfaces 102a, 102b, respectively, of the pocketed coil springs 102. If the innerspring assembly 100 includes top and/ bottom scrims (not shown), the sheets of padding material 152a, 152b are attached to the outer surfaces of the top and bottom scrims, respectively. In one embodiment of the invention, the sheets of padding material
20 152a, 152b are attached to the pocketed coil springs 102 (or the top and bottom scrims) via an adhesive material, such as, for example, a hot melt adhesive. However, other methods of attachment are also contemplated as would occur to one of skill in the art. It should be appreciated that the sheets of padding material 152a, 152b may include more than one layer of material arranged in a stacked configuration to form
25 multi-layered sheets of padding material 152a, 152b.

The outer covering 154 may include, for example, an upholstery covering or any other type of mattress upholstery material that would occur to one of skill in the art. In one embodiment of the invention, the outer covering 154 is attached to the sheets of padding material 152a, 152b via conventional upholstering techniques.

5 However, other methods of attachment are also contemplated as would occur to one of skill in the art.

Referring to FIG. 7, shown therein is a coil innerspring assembly 300 according to another form of the present invention. Similar to the innerspring assembly 100 illustrated in FIG. 1, the innerspring assembly 300 is generally
10 comprised of a plurality of pocketed coil springs and has a length l extending generally along a longitudinal axis L and a width w extending generally along a transverse axis T. Furthermore, like the innerspring assembly 100, the innerspring assembly 300 includes at least two sets or groups of pocketed coil springs 102, 104 having different pocketed heights h_1 and h_2 , respectively. However, it should be
15 understood that in other embodiments of the invention, the innerspring assembly 300 may include three or more sets of pocketed coil springs, with each set of pocketed coil springs having a different pocketed height. Additionally, it should be understood that the pocketed coil springs 102, 104 that form the innerspring assembly 300 can take any of the alternative configurations and arrangements described above with regard to
20 the innerspring assembly 100.

Similar to the innerspring assembly 100, the pocketed coil springs 102, 104 of the innerspring assembly 300 are arranged in axially extending rows R running along the length l (i.e., in a head-to-toe direction). However, unlike the innerspring assembly 100 in which each row R_1 , R_2 is comprised entirely of the coil springs 102
25 or entirely of the coil springs 104, respectively, with each coil spring in each row

having the same pocketed height h_1 , h_2 , the innerspring assembly 300 includes rows R that are comprised of a combination of coil springs 102, 104 having different pocketed heights h_1 , h_2 . In other words, each row R is comprised of a number of the pocketed coil springs 102 and a number of the pocketed coil springs 104.

5 In the illustrated embodiment of innersprings assembly 300, the pocketed coil springs 102, 104 arranged in an alternating manner along the length l of each row R. Additionally, adjacent rows R are arranged such that the pocketed coil springs 102 in one row are positioned laterally adjacent a pocketed coil spring 104 in the adjacent row. In this manner, the innerspring assembly 300 is configured such that the
10 pocketed coil springs 102, 104 are arranged in an alternating manner along both the length l and width w of the innersprings assembly 300. In other words, a pocketed coil springs 102 is positioned axially adjacent and laterally adjacent each of the pocketed coil springs 104. As a result, the innerspring assembly 300 tends to have a greater degree of dispersion between the coil springs 102 defining the pocketed height
15 h_1 and the coil springs 104 defining the pocketed height h_2 . The increased dispersion between the pocketed coil springs 102, 104 tends to provide the innerspring assembly 300 with a more uniform feel across both the length l and the width w .

 Similar to the innerspring assembly 100, the rows R of the pocketed coil springs 102, 104 which form the innerspring assembly 300 may be formed as
20 integral/continuous strips or strings S. Likewise, adjacent strips S of the pocketed coil springs 102, 104 may be coupled together to form dual strips S_D and/or triple strips S_T of pocketed coil springs. Additionally, two or more of the dual strips S_D and/or the triple strips S_T of pocketed coil springs may subsequently be coupled together to form the innerspring assembly 300. The innerspring assembly 300 may then be integrated
25 into an innerspring mattress, such as, for example, the innerspring mattress 150

illustrated in FIG. 6.

Referring to FIG. 8, shown therein is an innerspring assembly 400 according to another embodiment of the present invention. Similar to the innerspring assembly 100, the innerspring assembly 400 is generally comprised of a plurality of pocketed coil springs 102, 104' arranged in rows R_1 , R_2 , respectively, and defining different pocketed heights h_1 , h_2 , respectively. Likewise, adjacent rows R_1 , R_2 of the first and second sets of pocketed coil springs 102, 104' are arranged such that the mid-portions or waists of the pocketed coil springs 102, 104' extend generally along a central midline axis M, thereby defining an upper offset o_U between the upper pocketed coil spring surfaces 102a, 104a' and a lower offset o_L between the lower pocketed coil spring surfaces 102b, 104b'. However, unlike the innerspring assembly 100, wherein each of the pocketed coil springs 102, 104 is barrel-shaped, the innerspring assembly 400 includes a combination of barrel-shaped pocketed coil springs 102 and hourglass-shaped pocketed coil springs 104'. The barrel-shaped coil springs 102 have a convex side surface 102c while the hourglass-shaped coil springs 104' have a concave side surface 104c'. The adjacent rows R_1 , R_2 of the pocketed coil springs 102, 104' are arranged such that the convex side surfaces 102c of the pocketed coil springs 102 are positioned proximately adjacent or nestled/nested within the concave side surfaces 104c' of the adjacent pocketed coil springs 104', with the side surfaces 102c, 104c' preferably being in direct contact with one another.

The innerspring assembly 400 functions in a manner similar to that of the innerspring assembly 100. Specifically, when an occupant lies down on the innerspring assembly 400, a grouping of the barrel-shaped coil springs 102 having the greater height h_1 will absorb the initial loading associated with the weight of the occupant. However, as the coil springs 102 are compressed and the upper surface

102a of the coil springs 102 are displaced to a position generally flush or even with the upper surface 104a' of the adjacent coil springs 104' (i.e., with the upper offset ou at or near zero), the coil springs 104' will also be compressed and will begin to absorb a portion of the loading associated with the weight of the occupant. As a result, the
5 pocketed coil springs 102 provide the innerspring assembly 400 with a soft or “plush” feel to provide the occupant with an added degree of comfort, while the combined effects of the pocketed coil springs 102, 104' provide the innerspring assembly 400 with an added degree of support or firmness. As discussed above, since hourglass-shaped coil springs are generally firmer compared to barrel-shaped coil springs (i.e.,
10 exhibiting an increased resistance to compression or loading), inclusion of the hourglass-shaped coil springs 104' tends to provide the innerspring assembly 400 with an enhanced degree of support or firmness as compared to the innerspring assembly 100. Additionally, the nestling/nesting of the convex side surfaces 102c of the barrel-shaped coil springs 102 proximately adjacent the concave side surfaces 104c' of the
15 adjacent hourglass-shaped coil springs 104' provides the innerspring assembly 400 with a relatively more compact or concentrated coil spring configuration along the width w of the innerspring assembly 400.

It should also be appreciated that the innerspring assembly 400 may be configured similar to the innerspring assembly 200 illustrated in FIG. 3. Specifically,
20 the pocketed coil springs 102, 104' may be arranged in an alternating manner along both the length l and width w of the innersprings assembly 400. In this alternative arrangement, a barrel-shaped coil spring 102 would be positioned axially adjacent and laterally adjacent each of the hourglass-shaped coil springs 104'. This alternative arrangement would tend to provide a greater degree of dispersion between the barrel-
25 shaped coil springs 102 and the hourglass-shaped coil springs 104', which in turn

would provide a more uniform feel across the length l and width w of the innerspring assembly 400. Moreover, this alternative arrangement would also provide an even more compact or concentrated coil spring configuration along both the length l and width w of the innerspring assembly 400.

5 Referring to FIG. 9, shown therein is an innerspring assembly 500 according to another embodiment of the present invention. Similar to the innerspring assembly 400, the innerspring assembly 500 is generally comprised of a plurality of barrel-shaped coil springs 102 and hourglass-shaped coil springs 104' arranged in rows R_1 , R_2 , respectively, and defining different pocketed height h_1 , h_2 , respectively. However,
10 the adjacent rows R_1 , R_2 of pocketed coil springs 102, 104' of the innerspring assembly 500 are arranged such that the bottom surfaces 102b, 104b' are substantially flush or even with one another so as to define an upper spring offset o_U between the upper surfaces 102a, 104a', but with no lower spring offset. The innerspring assembly 500 is particularly useful when used in association with one-sided innerspring
15 mattresses, commonly referred to as "no-flip" or "no-turn" mattresses, wherein the upper surfaces 102a, 104a' of the pocketed coil springs 102, 104' would preferably remain in an upwardly-facing direction.

Referring to FIG. 10, shown therein is an innerspring assembly 600 according to another embodiment of the present invention. Similar to the innerspring assembly
20 400, the innerspring assembly 600 is generally comprised of a plurality of barrel-shaped coil springs 102 and hourglass-shaped coil springs 104" arranged in rows R_1 , R_2 , respectively. Likewise, the adjacent rows R_1 , R_2 of the pocketed coil springs 102, 104" are arranged such that the convex side surfaces 102c of the barrel-shaped coil springs 102 are positioned proximately adjacent or nestled/nested within the concave
25 side surfaces 104c" of the adjacent hourglass-shaped coil springs 104", with the side

surfaces 102c, 104c" preferably being in direct contact with one another. However, unlike the innerspring assembly 400, the barrel-shaped coil springs 102 and the hourglass-shaped coil springs 104" of the innerspring assembly 600 define a uniform pocketed height h . In other word, the upper coil spring surfaces 102a, 104a" and the lower coil spring surfaces 102b, 104b" of the coil springs 102, 104" are arranged substantially flush or even with one another.

Although the coil springs 102, 104" of the innerspring assembly 600 have a substantially uniform height h , the hourglass-shaped coil springs 104" will exhibit a somewhat greater degree of firmness compared to the barrel-shaped coil springs 102 (i.e., an increased resistance to compression or loading). Additionally, the nesting/nesting of the convex side surfaces 102c of the barrel-shaped coil springs 102 relative to the concave side surfaces 104c" of the adjacent hourglass-shaped coil springs 104" provides the innerspring assembly 600 with a compact or concentrated coil spring configuration along the width w and/or length l of the innerspring assembly 600.

Referring to FIG. 11, shown therein is an innerspring assembly 700 according to another embodiment of the present invention. Similar to the innerspring assembly 100, the innerspring assembly 700 is generally comprised of a plurality of pocketed coil springs 102, 102' arranged in rows R_1 , R_2 , respectively, and defining different pocketed height h_1 , h_2 , respectively. Likewise, adjacent rows R_1 , R_2 of the first and second sets of pocketed coil springs 102, 102' are arranged such that the mid-portions or waists of the pocketed coil springs 102, 102' extend generally along a central midline axis M , thereby defining an upper offset o_U between the upper pocketed coil spring surfaces 102a, 102a' and a lower offset o_L between the lower pocketed coil spring surfaces 102b, 102b'. Additionally, the adjacent rows R_1 , R_2 of the barrel-

shaped coil springs 102, 102' are arranged such that the convex side surfaces 102c, 102c' are positioned proximately adjacent one another, and preferably in direct contact with one another. However, unlike the innerspring assembly 100, wherein each of the barrel-shaped coil springs 102, 104 has the same coil diameter D, the innerspring assembly 700 includes barrel-shaped coil springs 102' having a coil diameter D' that is somewhat less than the coil diameter D of the barrel-shaped coil springs 102.

The innerspring assembly 700 functions in a manner similar to that of the innerspring assembly 100. Specifically, when an occupant lies down on the innerspring assembly 700, the barrel-shaped coil springs 102 having the greater height h_1 and the large coil diameter D will absorb the initial loading associated with the weight of the occupant. However, as the coil springs 102 are compressed and the upper surface 102a of the coil springs 102 are displaced to a position generally flush or even with the upper surface 102a' of the coil springs 102' (i.e., with the upper offset ou at or near zero), the coil springs 102' will also be compressed and will begin to absorb a portion of the loading associated with the weight of the occupant. As a result, the pocketed coil springs 102 provide the innerspring assembly 700 with a soft or "plush" feel to provide the occupant with an added degree of comfort, while the combined effects of the pocketed coil springs 102, 102' provide the innerspring assembly 700 with an added degree of support or firmness. As discussed above, since coil springs having a smaller coil diameter are generally firmer than coil springs having a larger coil diameter (i.e., exhibiting an increased resistance to compression or loading), the inclusion of the smaller diameter coil springs 102' tends to provide the innerspring assembly 700 with an enhanced degree of support or firmness as compared to the innerspring assembly 100.

It should also be appreciated that the innerspring assembly 700 may be configured similar to the innerspring assembly 200 illustrated in FIG. 3, wherein the coil springs 102, 102' defining the differing coil diameters D , D' , respectively, may be arranged in an alternating manner along both the length l and the width w of the innersprings assembly 700. In this alternative arrangement, a coil spring 102 having a larger diameter D would be positioned axially adjacent and laterally adjacent each of the coil springs 102' having the smaller coil diameter D' . This alternative arrangement would tend to provide a greater degree of dispersion between the coil springs 102, 102', which in turn would provide a more uniform feel across the length l and width w of the innerspring assembly 700.

Referring to FIG. 12, shown therein is an innerspring assembly 800 according to another embodiment of the present invention. Similar to the innerspring assembly 700, the innerspring assembly 800 is generally comprised of a plurality of barrel-shaped coil springs 102 having a larger coil diameter D and a plurality of barrel-shaped coil springs 102' having a smaller coil diameter D' . Likewise, the coil springs 102, 102' are arranged in rows R_1 , R_2 , respectively, and define different pocketed height h_1 , h_2 , respectively. However, the adjacent rows R_1 , R_2 of pocketed coil springs 102, 102' of the innerspring assembly 800 are arranged such that the bottom surfaces 102b, 102b' are substantially flush or even with one another so as to define an upper spring offset o_U between the upper surfaces 102a, 102a', but no lower spring offset. The innerspring assembly 800 is particularly useful when used in association with one-sided innerspring mattresses, commonly referred to as "no-flip" or "no-turn" mattresses, wherein the upper surfaces 102a, 102a' of the pocketed coil springs 102, 102' would preferably remain in an upwardly-facing direction.

Referring to FIG. 13, shown therein is an innerspring assembly 900 according to another embodiment of the present invention. Similar to the innerspring assembly 700, the innerspring assembly 900 is generally comprised of a plurality of barrel-shaped coil springs 102 having a larger coil diameter D and a plurality of barrel-shaped coil springs 102" having a smaller coil diameter D'' . However, unlike the innerspring assembly 700, the barrel-shaped coil springs 102 and 102" of the innerspring assembly 900 define a uniform pocketed height h . In other word, the upper surfaces 102a, 102a" and the bottom surfaces 102b, 102b" of the coil springs 102, 102" are arranged substantially flush or even with one another. Although the coil springs 102, 102" of the innerspring assembly 900 have a substantially uniform height h , the coil springs 102" having the smaller coil diameter D'' will exhibit a somewhat greater degree of firmness compared to the coil springs 102 having the larger coil diameter D (i.e., an increased resistance to compression or loading).

Referring to FIG. 14, shown therein is an innerspring assembly 1000 according to another embodiment of the present invention. Similar to the innerspring assembly 100, the innerspring assembly 1000 is generally comprised of a plurality of pocketed coil springs 102 arranged in rows R_1, R_2 . However, unlike the innerspring assembly 100, each of the pocketed coil springs 102 has substantially the same pocketed spring height h . Nevertheless, since the rows R_1 of pocketed coil springs 102 are arranged at a different elevation compared to the rows R_2 of pocketed coil springs 102, an upper coil spring offset o_U is formed between the upper surfaces 102a of the first row R_1 of pocketed coil springs 102 and the upper surfaces 102a of the second row R_2 of pocketed coil springs 102. Similarly, a lower coil spring offset o_L is formed between the lower surfaces 102b of the first row R_1 of pocketed coil springs 102 and the lower surfaces 102b of the second row R_2 of pocketed coil springs 102.

The innerspring assembly 1000 functions in a manner similar to that of the innerspring assembly 100. Specifically, when an occupant lies down on the innerspring assembly 1000, the pocketed coil springs 102 in the rows R_1 (i.e., the pocketed coil springs 102 having the elevated upper surfaces 102a) will absorb the initial loading associated with the weight of the occupant. However, as a certain grouping of the pocketed coil springs 102 in the rows R_1 are compressed and the upper surface 102a are displaced to a position generally flush or even with the upper surface 102a of the pocketed coil springs 102 in the adjacent rows R_2 (i.e., with the upper spring offset o_U at or near zero), the pocketed coil springs 102 in the adjacent rows R_2 will also be compressed and will begin to absorb a portion of the loading associated with the weight of the occupant. As a result, the pocketed coil springs 102 in the rows R_1 provide the innerspring assembly 1000 with an initial soft or “plush” feel to provide the occupant with an added degree of comfort, while the combined effects of the pocketed coil springs 102 in the adjacent rows R_1 , R_2 provide the innerspring assembly 1000 with an added degree of support or firmness.

It should also be appreciated that the innerspring assembly 1000 may be configured similar to the innerspring assembly 300 illustrated in FIG. 7, wherein the coil springs 102 that are positioned at different elevations may be arranged in an alternating manner along both the length l and the width w of the innerspring assembly 1000. In this alternative arrangement, the pocketed coil springs 102 at the higher elevation would be positioned axially adjacent and laterally adjacent each of the pocketed coil springs 102 positioned at the lower elevation. This alternative arrangement would tend to provide a greater degree of dispersion between the coil springs 102 positioned at the higher/lower elevations, which in turn would provide a more uniform feel across the length l and width w of the innerspring assembly 1000.

As discussed above, coil springs that are pre-loaded/pre-compressed by a greater amount will tend to exhibit a greater degree of firmness (i.e., an increased resistance to compression or loading). It should be appreciated that this concept may be incorporated into the design of the innerspring assembly 1000. For example, referring to FIG. 15a, shown therein is coil spring 110 having an initial height h_i when in an uncompressed/free-standing/relaxed state. Referring to FIG. 15b, shown therein is coil spring 110' having an initial height h_i' when in an uncompressed/free-standing/relaxed state that is somewhat greater than the initial height h_i of the coil spring 110. As shown in FIG. 16a, the coil spring 110 is pre-loaded to a compressed state and encased within a spring pocket 112 to define a pocketed coil spring 102 having a pocketed height h . Similarly, as shown in FIG. 16b, the coil spring 110' is also pre-loaded to a compressed state and encased within a spring pocket 112 so as to define a pocketed coil spring 102' having a pocketed height h that is substantially equal to the pocketed height h of the pocketed coil springs 102.

Notably, even though the pocketed coil springs 102, 102' each have a substantially uniform pocketed height h and each utilizes similarly configured coil springs 110, 110' (e.g., the same wire diameter, coil diameter, spring material, etc.), since the initial uncompressed/freestanding height h_i of the coil spring 110 is somewhat less than the initial uncompressed/freestanding height h_i' of the coil spring 110', the pocketed coil springs 102, 102' will exhibit different degrees of firmness. More particularly, since the coil spring 110 is subject to a reduced amount of pre-compression/pre-loading compared to the pre-compression/pre-loading of the coil spring 110', the pocketed coil spring 102 will exhibit a lesser degree of firmness compared to the pocketed coil spring 102'. The lesser degree of firmness provided by the pocketed coil springs 102 relative to the pocketed coil spring 102' may be used to

further enhances the initial “plush” feel provided by the coil springs 102 as the occupant lies down on the innerspring assembly 1000, which in turn would provide the occupant with an enhanced degree of comfort. Additionally, the relatively greater degree of firmness provided by the pocketed coil spring 102' would provide increased
5 resistance to loading, which in turn would provide a greater degree of support to the innerspring assembly 1000.

While the invention has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character, it being understood that only the preferred embodiments have
10 been shown and described, and that all changes and modifications that come within the spirit of the invention are desired to be protected.

For example, it should be understood that one or more of the elements, features and/or characteristics of the embodiments of the invention illustrated and described above may be combined to form further embodiments of the present
15 invention. It should also be understood that the elements, features and/or characteristics of the embodiments of the invention illustrated and described above may be combined with the elements, features and/or characteristics disclosed in U.S. Patent No. 6,398,199 to Barber and the co-pending U.S. Utility Application entitled “Encased Coil Innerspring Assembly” (Atty. Docket No. 3050-136) may be combined
20 to form additional embodiments of the present invention.